INVENTIONS & INNOVATION

Project Fact Sheet

CROMER CYCLE AIR CONDITIONER

BENEFITS

- Reduces latent moisture to improve indoor comfort and air quality
- Eliminates need for stand-alone dehumidifiers to remove excess moisture
- Reduces air conditioner energy use between 12 and 40 percent
- Improves air conditioner efficiency by maintaining high evaporator coil temperature
- Increases energy savings as moisture loads increase
- Requires no maintenance of desiccant wheel for life of the air conditioning system

APPLICATIONS

The Cromer cycle air conditioner technology applies to residential air conditioning systems that use a wet coil and have humidity loads. Incorporating the Cromer cycle into an air conditioning system is a patented process that could be licensed to major manufacturers of air conditioning products. The technology's add-in desiccant wheel can also be included in the manufacture of existing air conditioner models cost effectively. In addition, the Cromer cycle technology can be applied in commercial air conditioning systems, with an even greater energy savings potential.

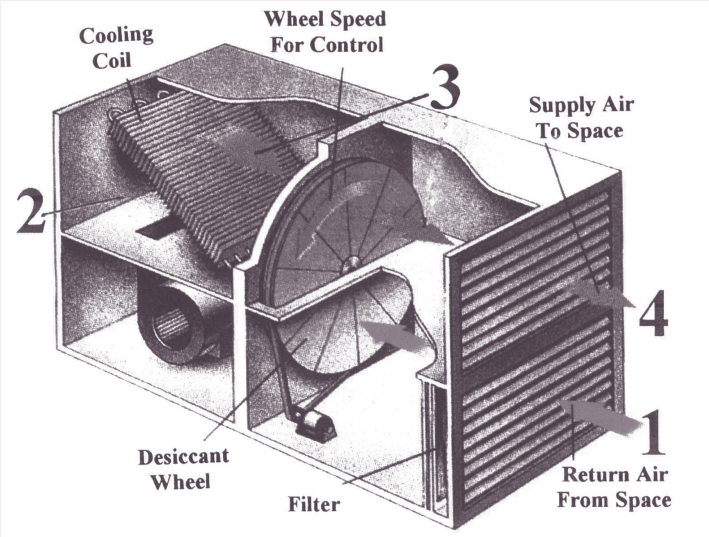
USING DESICCANT TO TRANSFER MOISTURE IN AIR CONDITIONERS INCREASES EFFICIENCY AND CAPACITY

When cooling a residential space to a comfortable temperature, two types of heat energy must be removed: temperature-associated sensible heat and moisture-associated latent heat. An air-conditioner coil usually operates by performing about 25 percent moisture removal and 75 percent cooling. If the sensible-heat ratio falls below 75 percent, then overcooling occurs in meeting the moisture-removal demand. This unnecessary cooling is usually rectified by adding heat to the space, consuming even more energy.

Latent-heat ratios often become higher than 25 percent in hot and humid climates, where fresh air introduction brings in significant levels of moisture, upsetting the temperature and moisture balance of interior spaces and reducing comfort levels. Excessive moisture in the air can also contribute to indoor air quality problems in buildings.

To combat these problems, the Cromer cycle air conditioner is being developed to reduce the energy consumption of air conditioning while increasing the moisture-removal capacity of the air conditioner coil. In the Cromer cycle air conditioner, desiccant is used to transfer moisture continuously from the supply air stream to the return air stream. This transfer enhances dehumidification of the coil without significantly reducing coil temperature, improving the efficiency of the refrigeration cycle. The drier air supplied to interior spaces increases comfort and indoor air quality.

CROMER CYCLE AIR CONDITIONING SYSTEM



The Cromer cycle air conditioning system uses a desiccant wheel for moisture exchange, increasing the moisture-removal capacity of the air conditioner coil while reducing energy consumption.

Project Description

Goal: Confirm the target performance of the new air conditioner technology through construction and monitoring of working systems.

The Cromer cycle air conditioner uses a rotating desiccant wheel to transfer moisture between the supply and return air streams of the air handler. Desiccant passing in front of the humid air leaving the coil absorbs moisture, so the duct system and conditioned space receive drier air. As the wheel turns, the desiccant transfers moisture to the dry air returning from the conditioned space. This dries the desiccant and increases the moisture in the air before it enters the cooling coil, making it possible for the coil to perform additional moisture removal.

Unlike colder coil systems, this technology maintains evaporator coil temperature, increasing both efficiency and capacity. Unlike other desiccant-assisted cooling systems, the Cromer cycle does not require high-temperature air to regenerate the desiccant, but relies on inherent vapor-pressure differential. Its efficiency allows the Cromer cycle to deliver increased dehumidification and a higher coefficient of performance, with energy savings exceeding other air conditioning systems.

The Solar Engineering Company is developing this new technology with the help of a grant funded by the Inventions and Innovation Program in the Department of Energy's Office of Industrial Technologies.

Progress and Milestones

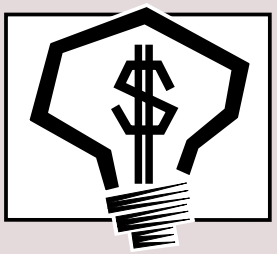
- Purchase and modify desiccant wheels for use in the Cromer cycle technology
- Obtain equipment for monitoring performance of installed residential Cromer cycle air conditioners.
- Calibrate instruments and install monitoring equipment.
- Modify two home air conditioning systems to run the Cromer cycle desiccant wheels.
- Run validation tests on performance parameters of installed systems.

Economics and Commercial Potential

The Cromer cycle air conditioner offers significant potential for energy savings in residential air conditioning. Laboratory tests of a Cromer cycle system showed a 16.4 percent reduction in energy use, while a 12 percent minimum reduction is targeted for operating residential systems. Estimates show that if the Cromer cycle were installed in 1.07 million residential central air-conditioning systems and resulted in 16 percent energy savings on these systems, the potential savings could equal 1.32 million barrels of oil per year.

Cromer cycle air conditioners would be used in hot, humid climates where wet coil air conditioners are used, totaling 17.12 million installed air conditioner units. With a 10 percent market penetration and energy savings of 12 percent, the potential energy savings of this technology equals 5.83 million kWh per year. If the market penetration in suitable applications reached 50 percent, savings potential would be 29.1 million kWh annually. Each year, 1.7 million wet-coil-type units are sold and their expected lifetime is 10 years. At 10 percent market penetration with a retail cost of $200 for the Cromer cycle add-in desiccant wheel, the retail market could equal $342.4 million annually.

The Electric Power Research Institute estimates that 30 percent of their residential customers use stand-alone dehumidifiers, which would not be needed with Cromer cycle air conditioners, offering additional energy-savings potential. The key to realizing these savings is to reorient the airflow of the supply and return air to direct the air flow through the desiccant wheel at the proper times in the cycle. With support from the U.S. Department of Energy, the developer is confident that this hurdle can be overcome.



The Inventions and Innovation Program works with inventors of energy-related technologies to establish technical performance and conduct early development. Ideas that have significant energy savings impact and market potential are chosen for financial assistance through a competitive solicitation process. Technical guidance and commercialization support are also extended to successful applicants.

Project partners

Inventions and Innovation Program
Washington, DC

Solar Engineering Company
Cocoa Beach, FL

For project information, contact:

Charles J. Cromer, P.E.
Solar Engineering Company
460 Indian Creek Drive
Cocoa Beach, FL 32931
Phone: (321) 638-1445
Fax: (321) 504-3421
charlie@fsec.ucf.edu

For program information, contact:

Lisa Barnett
Program Manager
Inventions & Innovation Program
U.S. Department of Energy
1000 Independence Ave., SW
Washington, DC 20585-0121
Phone: (202) 586-2212
Fax: (202) 586-7114
lisa.barnett@ee.doe.gov

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Office of Industrial Technologies
Energy Efficiency
and Renewable Energy
U.S. Department of Energy
Washington, DC 20585-0121

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